INCA ARCHITECTURE: THE FUNCTION OF A BUILDING IN RELATION TO ITS FORM

by

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This thesis provides research and information on various architectural constructions at four Inca sites in the Sacred and Urubamba Valleys of Peru: Cuzco, Saqsaywaman, Ollantaytambo, and Machu Picchu. It evaluates the relationship between construction technique and each structure's use, function, and significance within Inca culture. Specifically, architectural elements of the various structures are examined and classified, relative to the following categories: 1) function, 2) structure/form, 3) construction, 4) size, 5) frequency, and lastly, 6) layout. Through a systematic comparison of the sites, this thesis concludes that though all the sites were *elite* in Inca society, their construction varied in quality. A final analysis demonstrates that these sites follow primarily a hierarchy of construction, and that their function does relate to their form.

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INTRODUCTION

Archaeology is a discipline involving the reconstruction of past societies and their cultural way of life. Our hominid ancestors lived for millions of years, day by day, millennia by millennia, within a relatively static adaptation of hunting and gathering, using the same set of tools and undergoing relatively slow and discontinuous technological or cultural innovation. It was only with the emergence of modern humans that rapid cultural evolution came to characterize our human cultural adaptation. Even more recently, within the last few thousand years, human societies have evolved complex state-level societies and great empires. Although we possess a vast amount of information on the questions of *when* humans and their various cultures developed, we unfortunately know very little about *why* these events occurred (Wenke 1984).

Complex societies, having been established for thousands of years now, were often driven by the choices and actions made by a small group of people who felt the need to govern over a larger group of individuals (Silverman, 2004). The loss of individualism and shared roles among peoples in a society was due to the social and economic struggle upward within the elite class. For it was this motivation of the elites to gain wealth and power that ultimately, if incidentally, brought about the development of the arts, specialized crafts, architecture, and other attributes of complex societies. It is important to note that complex societies emerged independently in the Old and New Worlds, although these two separate worlds had similar characteristics in their patterns of development (Wenke 1984).

There are different ways in which people organize themselves socially, economically, and politically. Anthropologists observe humans and compare societies by means of categorizing them into bands, tribes, chiefdoms, states, and empires. Social groups can be relatively simple in their structure, as are those who live in bands and tribes. Conversely, organizations can be quite complex, as with states and empires. The latter two organized ways of living usually require a centralized government, control over a vast population and area of land, specialized craftsmanship, as well as other qualities (Wenke 1984). Complex societies are characterized by social hierarchy, they are non-egalitarian, and ranks of individuals are based on social status.

Often in societies with social hierarchy, architecture reflects differences in economic, political, as well as social position (Wenke 1984). One must remember that monumental forms of architecture demand significant amounts of labor. Upper class buildings (public, ceremonial, and administrative) are typically more finely-made structures than lower residential structures, and demand a greater input of labor in their construction. This is, in fact, a material correlate of elite control over the masses and complex socio-political organization, for it was the rulers and elites that directed the construction of monumental architecture while masses of commoners contributed their labor willingly to the construction of those monuments. There are also differences between structures within elite groups themselves and how well these buildings are constructed in comparison to one another, which likely reflect both status differentiations among the elite as well as differential function with respect to various types of architecture.

The Inca, an extremely hierarchical and highly complex imperialistic society in the South American Andes, are known for their ability to design and construct buildings with incredible precision. This thesis examines some of the extraordinary architecture of the Inca Empire and it

evaluates whether architectural form varies with respect to its functional context. In particular, I focus on the documented architectural remains from various locations within the important Inca city of Cuzco (its central-ceremonial core and areas outside this core, including the site of Saqsaywaman) as well as important sites in the Urubamba Valley (Machu Picchu and Ollantaytambo). I categorize the architectural remains at these sites into the following functional categories: a) high civic-ceremonial architecture; b) second-order ceremonial architecture; c) fortification architecture; d) elite residential/domestic architecture; and e) other domestic architecture. I then compare specific examples of architecture from these functional categories in terms of various architectural attributes, such as quality and type of stone (i.e., local; non-local; if non-local, how far from the site?), the size of stones used, the shape/design of stones (i.e., smooth, pillowed, or rough), the method of processing (i.e., pecking), and the form of the structures (i.e., curvilinear lined walls versus rectilinear lined walls), in addition to the location of the architecture within the broader site (i.e., central, peripheral, on high defendable land, etc.). This will be done using the Cuzco and the Sacred Urubamba Valley as a case study.

BACKGROUND

José Antonio del Busto D. (as cited in Protzen 1985:161) states that the "Inca culture had its origins in the Cuzco Valley of Peru (figure 1) around A.D. 1200. For some 200 years the Incas remained within their confines, governing over an agricultural state of minor importance." "It is [vital] to note that the term 'Inca' refers only to a small group of kindred, less than 40,000 individuals, who built a great Andean state by force of arms, and who ruled as the realm's governing nobility" (Moseley 2001:9). The Inca ended up conquering more than 4,000

kilometers of land extending from Ecuador down through Chile, encompassing over ten million people. The heartland of the empire was in the highlands of Cuzco, Peru. Though Incan rule lasted approximately only 100 years, from A.D. 1438 to A.D. 1532 when Spanish colonizers took over the land, the empire certainly made an impression on South America with their architectural abilities (Kaufmann 2006). The Incas called their state *Tawantinsuyu*, meaning "The Land of the Four Quarters", as it was built on top of the Cordillera (two converging tectonic plates) and filled with environmental diversity from extreme dry deserts to rich coastal shores to immensely thick jungles (Moseley 2001).

Figure 1. Map of Peru.
Source: RCR Wireless Americas 2011.

The Inca's internal structure was hierarchically organized through genealogical kinship collectives called *ayllus* (Moseley 2001). Specifically placing deities or godly figures at the top of the system, followed closely by the ruler and his immediate family, for the ruler claimed to be the direct descendant of the sun god Inti. Below them were the upper class nobles called *orejones*, followed by commoners who were known as *mitimacs* (taxpayers) or *runas*, and lastly, the servants and slaves, better known to the Incas as *yanakunas* (Kaufmann 2006).

Before launching into different aspects of settlement construction, it is important to note that architectural form for the Inca *did not* always designate function. There are a variety of building/settlement characteristics that the Inca used throughout their constructions. The most commonly used unit of architecture is the rectangular building; all settlements used this type, whether it was for residential housing, administrative purposes, or religious activities. These are very simple, one-roomed structures that could have slightly different characteristics among one another. These include: buildings with gabled roofs (figure 2); buildings having double rooms (one wall making a division between two buildings) where one side of the structure was completely open; and, finally, an open-sided building with a support beam for the roof (Hyslop 1990).

Basic changes in Inca architectural design brought about changes in public architecture. Another characteristic of Inca settlement construction is that of the circular and curved building (figure 3). The use of curvature in wall design is known to have been indicative of prestige. There are two kinds of rounded buildings, one used for religious structures and the other as administrative centers (Niles 1987). Although most buildings consisted of one story, "many administrative centers and military installations had at least one two-story building" with the entrance on the outside and steps ascending toward it (Hyslop 1990).

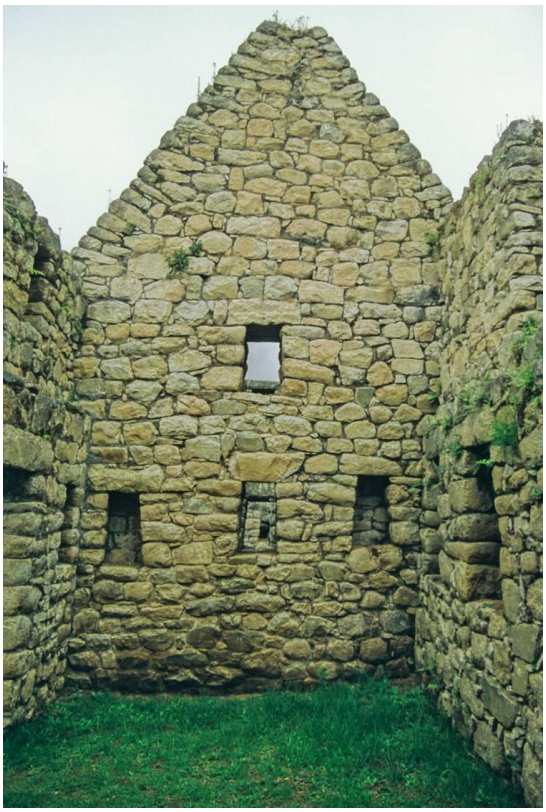

Figure 2. Gabled Roof.
Source: Courtesy of Dr. Timothy McAndrews.

Figure 3. Curvilinear Wall.
Source: Courtesy of Dr. Timothy McAndrews.

Other aspects of building characteristics are wall apertures and ornamentation. As for door and window openings, these generally took a square, rectangular, or trapezoidal design. The shapes of these apertures were used in all types of structures. However, it was the feature of double and triple jambs (figure 4) that gave elegance and prestige to the buildings which had them. Double and triple jambs are a type of ornamentation where the exterior area around the doorway and/or window is indented; this is a classic element of Inca architecture (Hyslop 1990).

Figure 4. Double-jamb Ornamentation.
Source: Courtesy of Dr. Timothy McAndrews.

Inca construction techniques are impressive, for the Inca did not have the modern technology that is available today. Around 1438, the ninth Inca, Pachakuti, demanded Cuzco to be rebuilt in stone. The stonemasons who ended up working on this project created a style of

masonry that was extraordinary and unknown to the world at the time (Protzen 1985). The materials acquired for a project depended on the kinds of resources that were accessible in the particular area of construction.

As for building materials in the highlands, quarries of limestone, granite, porphyry, and basalt were used for producing structures, through fieldstone and cut stone, with the latter (figure 5) being reserved for the utmost important construction sites of palaces, temples, and central fortresses (Kaufmann 2006).

Figure 5. Perfectly Cut Stones.
Source: Courtesy of Dr. Timothy McAndrews.

> It was with cut stone that the Inca excelled and achieved levels of incomparable perfection. These walls of cut stones were often of cyclopean dimensions and were put together not only without cement but with a precision that came within fractions of a millimeter. The Inca stonemasons' craft was not limited to the technical aspects. The aesthetic appeal of their work is evident in the manifold bonds, the associated geometries of joints, and the variety of wall textures achieved through differentiated surface treatments and juxtapositions. (Protzen 1985:162)

Architecture with cut stone has the precision and perfection that only seldom occurs in special construction areas outside of Cuzco. Most of the blocks used in Inca construction bulge out, appearing to have a "pillowed" look to them, and are usually of an irregular shape fitting extremely close together (figure 6). It is also imperative to keep in mind that these people *did not* have metal tools or the wheel *and* were able to dress and fit the stones together without the use of mortar (Hyslop 1990). The cutting of rock was performed through the use of hammerstones, plumb bobs, bronze pry bars and chisels, digging sticks and wood (McEwan 2006). As far as gathering and obtaining materials, there was a definite process for collecting stones used in construction (figure 7).

Figure 6. Pillowed processed stone of irregular shape.
Source: Courtesy of Dr. Timothy McAndrews.

Quarry sites abandoned in mid-work show that the stone cutters: **(1)** inserted hematite wedges into cracks in the bedrock and pounded them in with stone mallets, widening the cracks; **(2)** inserted wooden wedges into the cracks and poured water over them. The wet wood expanded, further widening and deepening the crack. **(3)** They also freed a block from its bed by chiseling the bottom out, and propping the freed sections with piles of smaller stones. The larger stone blocks were dressed on the building site and fitted into the surrounding rocks, so they could not slide out during an earthquake. The *mitimacs* [taxpayers] carried the stones from the quarry to the building site before they dressed them. The rough stone blocks were smoothed out with hammer stones of increasingly smaller size. The preferred rocks for this job were hard ones like obsidian or hematite. The 'percussion' technique shown **(4)** left small indentations on the surface of the stones. After large stones had been dragged to the building site by gangs of *mitimacs*, they were pulled into place up a stone ramp **(5)**: once the building was completed, the ramp was removed. Cyclopean stones were pulled with ropes and propped up with rocks until their base dropped into a hole specially dug to receive them **(6)**. (Kaufmann 2006:22)

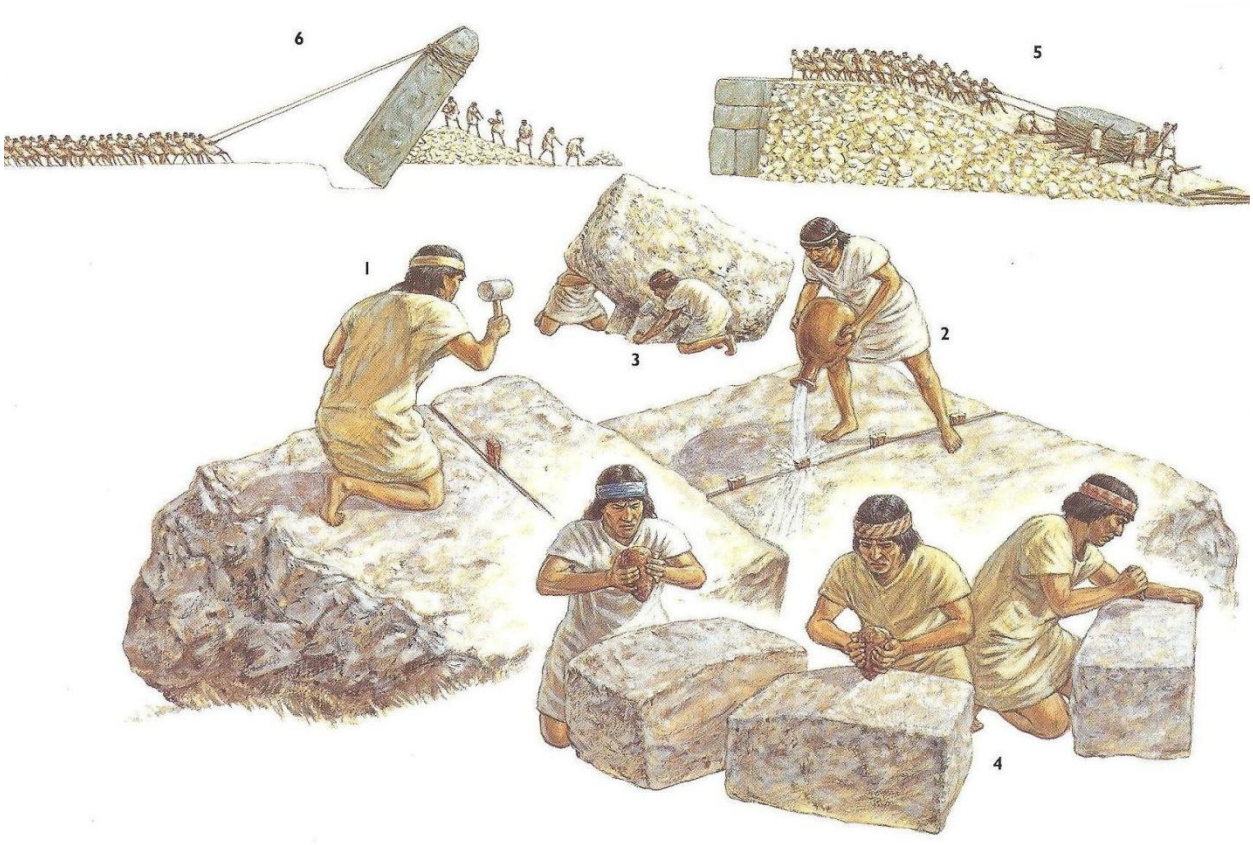

Figure 7. Construction Process.
Source: Kaufmann 2006:23.

Before moving on, I would like to follow up on the vital notion that when looking at the architecture and construction of a building, one must take in to account every aspect of detail the structure has to offer. This must certainly be done with ancient buildings and monuments because this type of analysis allows us to better understand the way of life for a particular society. An ancient structure, in many ways, is like a photograph, for it provides us with a glimpse into the past.

METHODOLOGY

In this portion of the study I examine the important Inca sites of Cuzco, Saqsaywaman, Ollantaytambo, and Machu Picchu. This will be done through the use of published maps of plan views, illustrations, photographs, and descriptions. I will also be looking at various aspects that are directly and indirectly related to architecture to answer the question of whether or not the function of the building has any relation to the form (i.e., the intrinsic value versus the instrumental value of the building). First, I will be looking at the buildings of each site and determining their *function*. It is important to know exactly how the structure was used and who and what it was made for before looking at its formal design as an independent piece of artistic architecture. Buildings consisted of one of the following functions: ceremonial (whether high-civic or secondary ceremonial); fortification/militaristic; administrative; public; and domestic. Once the function is determined, I will consider the *formal design* of the structure by observing architectural attributes such as rectilinear or curvilinear walls; the type of roofs used; whether the building has one or two stories; and how restricted the building design was meant to be. All of this will help determine the importance of the structure's intrinsic value as an artwork in itself.

Another aspect that needs to be considered is the *construction* of the building. Here I will be addressing three categories: 1) the process used on finishing the surface of the stone, 2) how the stones were fitted together, and 3) the amount of labor employed. For the finishing process I will look at the type of work that was being done on the stones used for construction, whether they are rough, finely carved, or pillowed. For the fitting of the stones, I will consider whether they are perfectly cut, polygonal, square, irregular, or fitted together such as if the building is constructed out of fieldstone and just placed together with little or no surface finishing or processing. I will also be discussing the relative amount of labor required for various structures. For example, in terms of labor, finely cut and smooth stone are the most intensive, followed by pillowing as the next most intensive, and the use of local fieldstone is the least intensive. I will also need to look at where the stones are coming from whether they are locally available or transported. I will then look at the size of the stones to determine the amount of labor used. For instance, the larger the stone, the more people it requires to carve and put into place.

I will also be considering whether the *size* of the structure plays a part in its architectural importance. Then I will look at the *frequency* of building styles used, that is, how often a building style is used, such as any niches or indentations within the walls; and the type of roofs being built, whether gabled, flat, or arched.

Next I will talk about the *layout* of the buildings, by looking at where exactly a structure is located, while viewing its context, namely, whether it is placed on a hill, in a plaza, in a valley, and in relation to its placement among other buildings. I will then look at the context of each and compare them to the features mentioned above with respect to function, form, size, frequency of style, and construction. I will also try to determine if the context plays any role in the

construction and layout. Lastly, I will be examining Inca architecture in general to determine if there are similarities and/or differences between different structures with different functions.

DATA PRESENTATION

This section provides the necessary data and information for examining Inca architecture at four sites (Cuzco, Saqsaywaman, Ollantaytambo, and Machu Picchu). The image below (figure 8) shows three of the four sites in question. This is because the site of Saqsaywaman is actually located within the boundaries of Cuzco, though for the purpose of this paper it is viewed as a separate site.

Figure 8. Map of the Urubamba and Cuzco Valleys.
Source: Cuzco 2000.

Cuzco

The Urubamba Valley is known as the Sacred Valley of the Incas, for it houses a number of major sites. Cuzco itself served as the capital of the Inca Empire and was the largest city in South America at the time. Located in the southern highlands of Peru, at an elevation of 3,395 meters above sea level, Cuzco housed more than 100,000 people.

The identification and function of certain buildings can be evaluated through archaeological excavations. It is also possible to reconstruct and understand building function through examining early written documents and looking at the structures themselves, many of which still exist today (in original form or through reconstruction). Cuzco happens to be known as the place where the finest Inca masonry is found. The layout of the city can be split up and discussed in two ways: 1) the central sector which was occupied by Inca rulers and was the core location for religious and political ceremonies; and 2) residential districts that surround the central sector (Hyslop 1990).

Cuzco supported a large plaza that was divided into two parts by the Saphy River; the east side was called Kusipata and the west side Haukaypata. Two great compounds, known as Hatunkancha and Amarukancha supported the southeast side of the Haukaypata plaza with its various important buildings. Hatunkancha was a one story structure that housed *aqllawasi* the "chosen women of the sun." As it was a ceremonial center of high prestige it was very much restricted and enclosed in terms of its construction. Its east side wall (which still exists) faces Loreto Street (back then known as the Sun Street) and its status is one of the most famous in Cuzco today, for it is constructed of fine Inca masonry of perfectly cut and fitted stone. The compound of Amarukancha, on the other hand, has less restricted access and is noted to have had a *galpón* or large hall facing the plaza of Huakaypata. This structure was a very tall, rounded

building with a conical thatched roof. Most of the well-crafted structures surrounding the plaza, however, were similar to these large *galpones* and held vast quantities of goods (Hyslop 1990).

The northwest side of the Haukaypata plaza houses yet another finely constructed building known as the palace of Wayna Qhapaq, located in the compound of Qasana. It is here that fine Inca masonry can once again be seen, yet, with characteristic variation. Though these walls are finely processed, like those mentioned above, they also contain well-crafted trapezoidal niches (figure 9) (Hyslop 1990). To achieve this style, the design of the foundation was laid out and the frames of the walls were then put together with the stones in a systematic and symmetrical manner that allowed for the construction of these niches or open slots (Niles 1987).

Figure 9. Trapezoidal Niches at Cuzco.
Source: Modified from Dr. Timothy McAndrews.

Among other important structures is a gold-covered stone resting on a platform placed at the midsection of the two plazas. This structure is highly recognized, for it represents Inca architecture in many large settlements throughout Tawantinsuyu. As historical documentation notes, Cuzco's plaza was built on a terrace that housed multiple structures which seemed to cancel out the domination of one structure over another (Hyslop 1990).

The Inca must have found the quality of stone used in construction to be very important. This is because some structures are made out of materials that are not local but rather come from quarries thirty-five kilometers away. If the Inca felt compelled to travel over vast areas of land for high quality stone, this perhaps indicates that certain structures must have been regarded as more worthy and called for more organized and intensive labor. The quarries of Rumiqolqa provided much of the andesite, columnar or basalt, and boulder-like rocks used in the construction of Cuzco. The stones were removed from the quarry in the proper sense of breaking the rock off the face of the bedrock or extracting the stone from pits. From here, the stonemasons would place the stones on ramps and drag them all the way to Cuzco (Protzen 1985).

In addition to fine masonry being considered significant in their use of construction, many stones and outcrops were used in Inca architecture throughout the Urubamba Valley. The integration of these features into construction suggests the importance of architectural planning, since boulders and outcrops often form parts of terraces, walls, plazas, or just freestanding features that possess significance by themselves (Hyslop 1990).

Focusing on one of the Inca's most famous structures, we come to what is known as the Coricancha, or the Temple of the Sun (Moseley 2001). Located within the central sector, the function of the Coricancha was strictly ceremonial and was the apex of all religious structures

throughout Inca territory. This building has the most perfectly cut rectilinear *and* curvilinear wall formations of all Inca structures. It is on the southwestern side of the temple that the most extremely fine masonry of the curvilinear style is seen (figure 10) (Hyslop 1990).

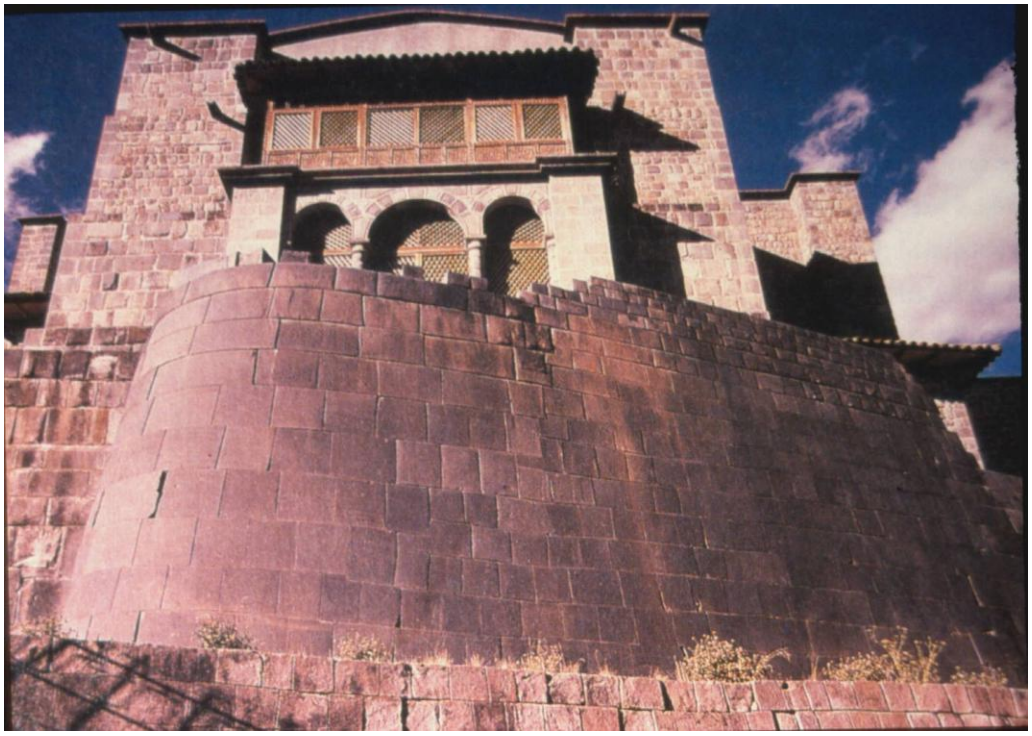

Figure 10. Curvilinear Wall at the Coricancha.
Source: Courtesy of Dr. Timothy McAndrews.

Coricancha means the "golden enclosure" due to the heavy use of gold decoration in the temple's walls, ceilings, altars, statues, and vessels. Unfortunately the spectacular décor was looted by Spanish invaders (McEwan 2006). The Temple of the Sun was the *axis mundi* of the Inca cosmos and the place of worship to the gods, or deities, which made up the constellations and celestial phenomena. The design of the building and its rooms mirror the orientation of the sky, from the rising and setting of the sun to the position of the constellations and stars. As part of being the center for all of Tawantinsuyu, the Coricancha is the starting place for the Inca *ceque* system (Farrington 1992). From each corner of the building and from areas near it, a

ceque road, or highway, extends out into the landscape to a place of ritual importance with more than 300 *huacas*, or sacred shrines, built along the way (Reinhard 2007).

Saqsaywaman

Saqsaywaman is regarded as the most elaborate and prestigious fortress of all Inca architecture. Located just three kilometers north of Cuzco the site sits on top of terraces overlooking the capital. Its outer walls are compiled of massive boulders which serve a defensive purpose. In addition to being a protective compound, Saqsaywaman also served a religious function (Kaufmann 2006). The structure stored militaristic gear and may have held ritual battles in its plaza; the site is also noted as a place for the "House of the Sun" (Hyslop 1990).

Today Saqsaywaman looks quite different than it did in its prime and we can only imagine how impressive the architecture of the complex must have been. This is because in A.D. 1532 the Spaniards arrived and took over the Inca Empire. Despite how incredible the site was to the conquistadors, they unfortunately dismembered numerous blocks from the compound to be used in creating their own capital. Saqsaywaman was documented in A.D. 1534 by the Spaniard Pedro Sancho. He describes the site as having one main tower in the center of a plaza consisting of four or five stories and multiple habitations surrounding the tower which had many chambers of beautifully worked stone. The stones making up the walls were so monstrous and smooth and fit together so closely that mortar does not seem present. Anyone who sees them would say they were not placed there by man. Sancho describes the fortress as a magnificent storehouse (Hyslop 1990).

All that is left of the site today are the foundation boulders of the defense walls and a few structural parts that made up the inner plaza. The layout of the site is compiled of one wall on top of a cliff on the south side facing Cuzco. The northern side, however, is made up of three

gigantic zigzag walls, each built on a terrace (figure 11) (Kaufmann 2006). The stones are quite massive and are of a smooth pillowed looked (figure 12). Some are so large that they weigh in at 100,000 kilograms (220,000 pounds or 110 tons) (Protzen 1986). Because the Inca only had manpower and no modern technology, it can be quite difficult to accept the fact that these people did indeed move the giant boulders (figure 13) and were able to construct the monuments they did. The Inca poured a massive amount of labor into the production of these structures and used large quantities of vine and hemp rope in the transport and placement of the huge stone blocks (Hyslop 1990).

Figure 11. Defense Walls at Saqsaywaman.
Source: Kim MacQuarrie 2007.

Figure 12. Defensive Wall at Saqsaywaman.
Source: Modified from Andean Travel Web 2011.

Figure 13. Blocks of Stone at Saqsaywaman.
Source: Modified from Dr. Timothy McAndrews.

The quarry sites of Rumiqolqa were used for gathering the material, as it was for other construction in the Cuzco area. The stonemasons at these sites broke the rock off the face of the quarry and, for the most part, finished dressing the stones before bringing them to the building site for placement. However, it is interesting to note that the stones coming from Rumiqolqa do not have the telltale marks on them that would represent the action of dragging them to the site. How did the Inca transport these massive boulders then? The answer to this question still remains hidden, yet we know for a fact that all Inca construction was done by human power. Once the chosen stones were at the complex and placed together, minor adjustments were done to shape the rock to perfect the fitting of the stones together (Protzen 1986). Saqsaywaman is the largest monument constructed by the Inca, though it was never fully completed, even after fifty years of construction (Hyslop 1990).

Ollantaytambo

Located at the heart of the Urubamba Valley (northwest of Cuzco and southeast of Machu Picchu) between the Urubamba and Patakancha rivers, sits the site of Ollantaytambo. Constructed as a multipurpose site, there is evidence for it serving as an occasional place of shelter for the Inca in times of war as well as having other administrative-religious-military aspects. For instance, it was also a royal estate for the Inca ruler Pachakuti and has evidence of intensive agricultural production that sustained a population up to 1,000 inhabitants year round. Before the Spanish conquest and seizure of Ollantaytambo, the Inca used the site for political and administrative functions; however, the architecture also reveals ceremonial aspects; and most likely served as a way station for travelers as well (Protzen 1993).

The layout of the site shows its defensive function (Kaufmann 2006). Similar to the site of Saqsaywaman, Ollantaytambo is built on terraces and is surrounded by large retaining walls,

reminding us of the militaristic nature of the Inca (Hyslop 1990). The fortress is situated on a ridge going in an east-west manner and is divided into two sectors by the Patakancha River. The east sector, known as *Qozqo*, is a large area located on sloping land that is planned in a trapezoidal grid shape. It is also thought of as the "town" area at the site. The west sector, *'Araqhama*, though smaller, is not set up like a grid but does have an orderly street pattern with open block designs. The west side is characterized by oversized gates and doorways and is thought to have had ceremonial or administrative functions. Within the east and west sectors are four distinct areas: the Temple sector, Middle sector, Funerary sector, and the Pumatallis (figure 14) (Protzen 1993).

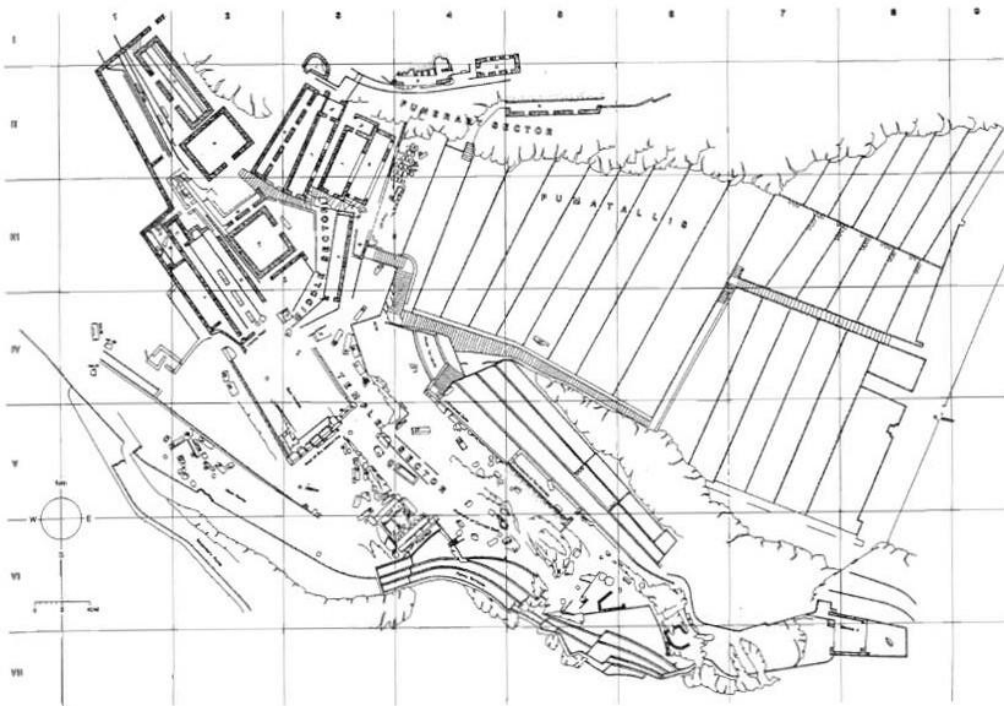

Figure 14. Map of the Layout of Ollantaytambo.
Source: Protzen 1993:75.

The north and south ends of the site have no natural protection; therefore defense walls were constructed. At the core of the fortress, known as Pumatallis, is displayed with multiple defense terraces overlooking the city of Ollantaytambo (figure 15). A very steep yet massive staircase goes along the south end of the terraces ascending to an amphitheater at the very top (Protzen 1993).

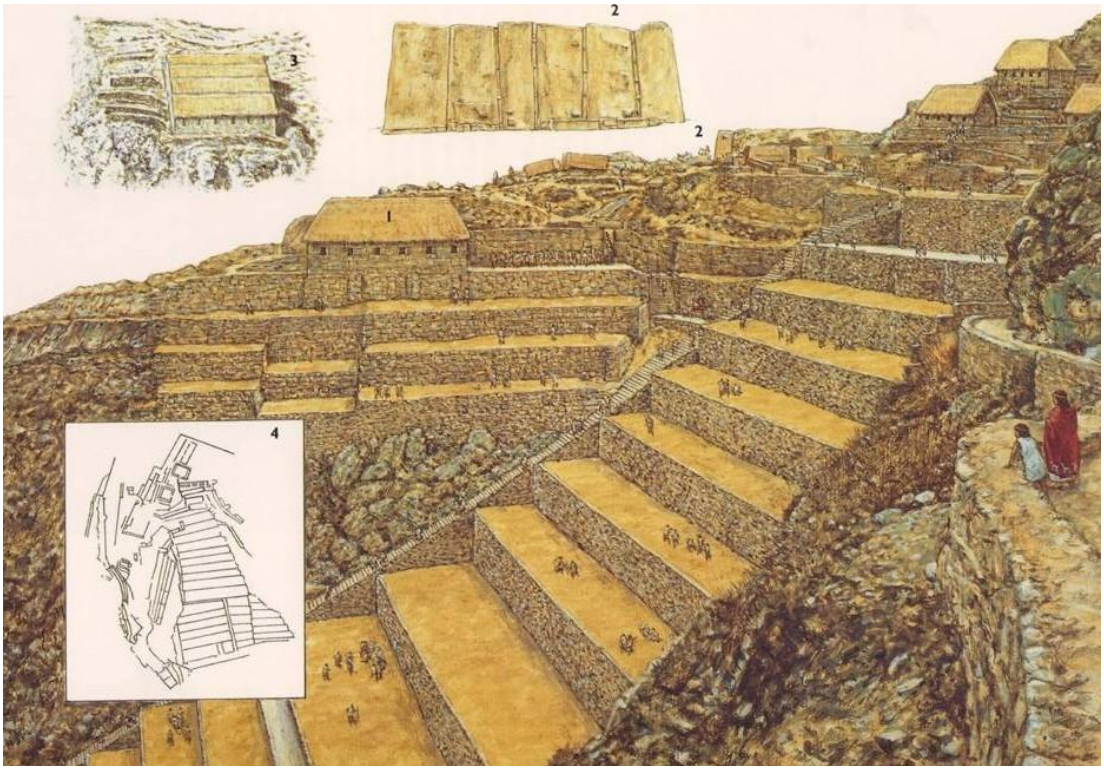

Figure 15. Reconstructive Drawing of Ollantaytambo.
Source: Kaufmann 2006:43.

The Temple sector, located south of the Pumatallis, holds the most important structure at Ollantaytambo, the Sun Temple (Protzen 1986). Built around an outcrop, the structure consists of "cyclopean dimensions" and various other qualities, as it was constructed under the direction of multiple architects through many years. The architects wanted the Sun Temple to be distinct and so they built the walls by reusing recycled blocks and filling any spaces with rubblework.

Another building in the Temple sector is the Enclosure of the Ten Niches. It is designed as a typical Inca structure in that it has a single rectangular room, doors that are trapezoidal in shape, as well as niches. Despite these common characteristics, the Enclosure of the Ten Niches does have an attribute that is not found outside of Ollantaytambo. This attribute is the projection of a subtle tail into the crease or joint of the stones placed below it (figure 16) this is known as *scutiform* masonry (Protzen 1993). Perhaps this unique attribute enhances the status of the structure at the site.

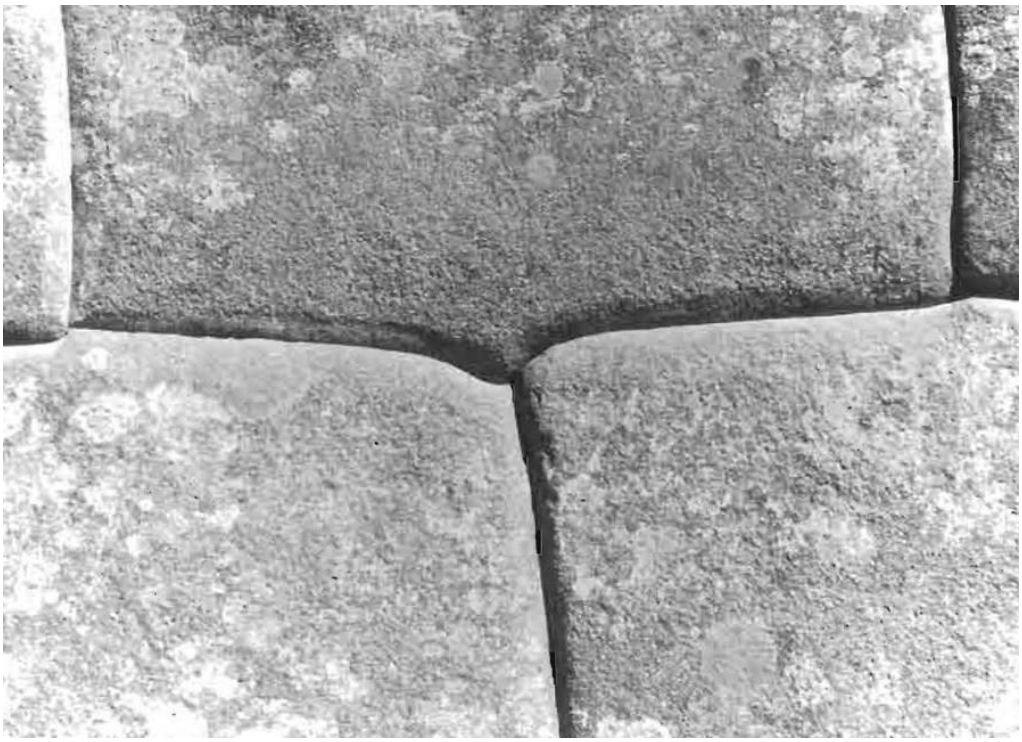

Figure 16. Subtle Tail.
Source: Protzen 1993:84.

It is vital to keep in mind that form *does not* always follow function. The overall architecture of the Enclosure of the Ten Niches reminds us that any structure can be designed with common Inca characteristics and still have prestige, for it is necessary to remember that the function and location of the building is just as important to the structure's overall meaning.

Although this particular building may look no different from a common Inca structure, it has features that represent its importance, such as the *scutiform* masonry, and it is located within the Temple sector.

The architecture at Ollantaytambo is comprised of two types: one is of square cut and fitted stone, and the second is compiled of lessor fieldstone. Located four kilometers on the other side of the Urubamba River are the quarries of Kachiqhata which were used in the construction of Ollantaytambo. The stones from these quarries are of coarse-grained red granite that were specifically used in the Temple sector of the fortress, as well as stone of finer-grained grayish granite, limestone, ignimbrite, and rhyolite that were used for the rest of the fortress (Protzen 1993).

Although the proper Inca quarrying method of obtaining stone was the cutting or detaching of pieces from the face of the bedrock, the stonemasons working on this project sought stones that met the project's needs and were, for the most part, ready for the taking. Minimal work was done to these stones before being launched on ramps and taken to Ollantaytambo, for it was at the construction site that these stones were worked on and adjusted to be fitted and placed. The stones at the fortress acquired pit scars in the middle, while the edges are more finely dressed. These aspects are due to the use of different sized hammerstones: larger ones applied to the middle of the stone's face, and smaller ones for around the edges (Protzen 1985).

Machu Picchu

Situated on top of a mountain peak 2,700 meters above sea level is the most famous of all Inca sites, Machu Picchu (figure 17). Constructed with elite domestic houses and religious centers overlooking the Urubamba River, this Inca paradise housed as many as 1,000 inhabitants (Kaufmann 2006). Before the Spanish conquered the Inca Empire, Machu Picchu was already

abandoned and therefore never found by the invaders. It was not until July 24, 1911 that the 'lost city' became internationally known from the scientific excavation done by Hiram Bingham III (Pringle 2011). Fortunately for us, despite weathering and other naturally occurring forces (i.e., earthquakes), the city in the sky looks very much as it would have in its prime 500 years ago since no one knew of its existence and therefore could not dismember it (Wright and Zegarra 2001). However, since the site was indeed abandoned and the fact that there is a lack of colonial written records of the site, it is important to observe current-day Inca beliefs, values and architecture from nearby settlements and the Cuzco region, as well as conduct archaeological excavations at the site to get at the questions that surround Machu Picchu (Reinhard 2007).

Figure 17. Machu Picchu.
Source: Machu Picchu Travel Guide 2010.

Machu Picchu (figure 18) is situated on top of a long ridge of manmade terraces and naturally formed cliffs, both of which add to the site's protection. Interestingly, more outcrops and special boulders are seen at this settlement than any other Inca site. The overall design and planning had to incorporate all these natural attributes into the placement of the houses and religious centers. It has been suggested that these natural features served an ideological purpose to the Inca and were either modified or left alone to mirror mountain peaks and the horizon (figure 19) (McEwan 2006). For these sacred geographical features (i.e., mountains, boulders, caves, lakes, rivers, and springs) are believed to house the Inca deities and have supernatural and ideological powers (Reinhard 2007).

Figure 18. Map of the Layout of Machu Picchu.
Source: Hyslop 1990:109.

Figure 19. Shaped Stones to Mirror the Mountainous Landscape.
Source: Courtesy of Dr. Timothy McAndrews.

Buildings were not only constructed to face sacred mountains and landscapes, but were oriented with the sky and celestial phenomenon as well. One such building, the Torreón (tower) (figure 20) is a religious structure of fine curvilinear masonry reminiscent of the Coricancha in Cuzco. It was built as a semicircle around a natural boulder that was carved (Wright and Zegarra 2001). The Torreón serves as an astronomical observatory and has a window on the east side that points to the azimuth of 60 degrees and 95 minutes; which happened to be consistent with the rise of Pleiades and the summer solstice in the time of Inca occupation (figure 21). Another window in the structure faces southeast, allowing for the observance of several constellations important to the Andean civilization (Hyslop 1990). Other religious structures that give the site religious importance are the Principle Temple, the Intihuatana, the Temple of the Moon, the Priest's House, and the Temple of Three Windows (Reinhard 2007).

Figure 20. The Torreón at Machu Picchu.
Source: Modified from Dr. Timothy McAndrews.

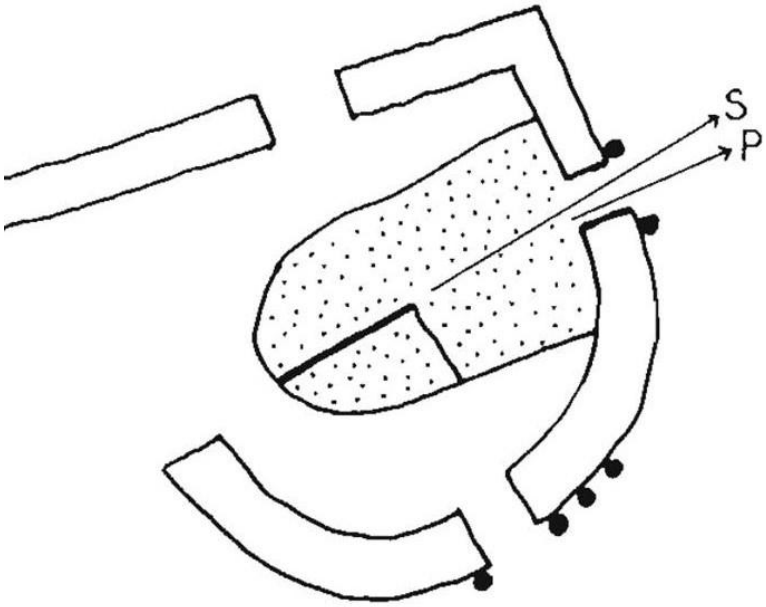

Figure 21. The Torreón as an Astronomical Observatory.
Source: Modified from Hyslop 1990:230.

Although Machu Picchu is an elite site with characteristics of fine stonemasonry and curvilinear walls made of granite, the construction of the domestic houses were, more or less, of the typical Inca style. As evidenced by multiple photographs, illustrations, and descriptions, the houses at this site were designed with rectilinear walls, consisting of one or two stories in height, gabled roofs (thatched), and were built out of ordinary fieldstone with no particular concern to their placement. This type of construction did not require the intensive amount of labor that is needed to process things such as perfectly cut stones or moving massive boulders that weigh thousands of pounds.

SYSTEMATIC COMPARISON OF INCA ARCHITECTURE

I would now like to systematically compare and contrast specific architectural features at Cuzco, Saqsaywaman, Ollantaytambo, and Machu Picchu. Each one of these sites, although different, does have similar functions. For instance, all the sites are *elite* and hold some aspect of significance in the form of religious features. Cuzco and Machu Picchu possess buildings with curvilinear walls, which are solely seen with religious structures. However, Cuzco is also considered to be a site containing high-civic ceremonial structures, whereas Machu Picchu would be considered more of a secondary ceremonial site. As for Saqsaywaman and Ollantaytambo, these two sites also possess evidence of ritual activity and ceremonial architecture, though it is not as impressive as the former two sites. Cuzco, Saqsaywaman, and Ollantaytambo all provide evidence that they sustained administrative functions. As for the domestic residential function, this fits more in with the sites of Cuzco and Machu Picchu than

Saqsaywaman and Ollantaytambo, which seem to provide more of a militaristic and refuge function.

Regarding characteristics of formal design at the sites, Cuzco is the capital and contains the greatest formal quality in its buildings. The Coricancha in Cuzco is the center of the Inca cosmos and is the utmost religious structure, or any structure for that matter. Its design consists of a curvilinear wall with perfectly cut stone that is fitted together without mortar with such precision that it seems as if it were constructed just yesterday using modern technology. Many of the structures at Cuzco have tall walls surrounding buildings, restricting access and giving them a more prestigious status. The site of Saqsaywaman shows its own design of restricted access with massive boulders making up the defensive walls surrounding any structures in the main plaza. Ollantaytambo has its own impressive design with its defense of terraces, situated so that they may be seen first before any other structure. Machu Picchu has a formal design of more simple features. However, all of the sites have structures of one or more stories and possess evidence of having had thatched gabled roofs.

All four sites use non-local stone that was collected from distant quarries. Through my research I was able to find the exact quarries used for Cuzco, Saqsaywaman, and Ollantaytambo, though I was unable to come across an exact location for the stones used at Machu Picchu. As for the construction and dressing of the stones, those at Cuzco and Saqsaywaman have irregular polygonal pillowed shapes that were fitted together. Cuzco, Ollantaytambo, and Machu Picchu all possess fitted block of stones featuring a square shape. Cuzco alone show structures constructed of perfectly square-cut stones fitted together. Machu Picchu is most unique for its consistent use of ordinary fieldstone, though all of the sites used this common method of

construction on occasion. A final but important feature of construction is that all of the sites have buildings with blocks that are fitted together without mortar.

The frequency of certain stylistic building features is also helpful in determining how important a structure is. For instance, niches and indentations in walls, as well as thatched roofs, are both frequent throughout the four sites. However, it is the limitation of the double and triple-jamb ornamentation seen on structures that allows us to assume that the buildings with these features were of more importance than those buildings which did not.

Before considering Inca architecture in general, I would like to discuss the layout of the sites and their buildings. First off, Cuzco has two sectors: a central core with public structures that is surrounded by a larger sector made up of residential districts. This type of setup suggests that the public structures held more importance because of their central placement, making access to them more difficult. The Saqsaywaman site is laid out on the top of a cliff that overlooks Cuzco. Its importance is also demonstrated by its having (though gone now) a plaza in the center constructed of beautiful buildings that are in relatively close proximity to one another, all surrounded by massive defense walls. Looking at Ollantaytambo's layout, we see that the site is built on a ridge in a valley between two rivers and overlooking the city below it. The dominate features at this site are the terraces located on the east side of the complex which lend an overwhelming sense of importance to the complex. The buildings at this site are located closer to the top of the ridge, behind and adjacent to the terraces. Lastly, Machu Picchu is laid out on top of a mountain which in itself provides prestige since mountains and other aspects of lofty landscapes were highly regarded. The houses were built connected to one another while the religious structures were set apart from all others and located more in open space (table 1).

Table 1. Systematic Comparison of the Sites.

	Cuzco	**Saqsaywaman**	**Ollantaytambo**	**Machu Picchu**
Religious	X	X	X	X
Administrative	X	X	X	
Militaristic		X	X	
Domestic	X			X
Perfectly Cut Stones	X			
Pillowed Stones	X	X	X	
Fieldstone	X	X	X	X
Non-local Stone	X	X	X	X
Curvilinear Walls	X			X
Polygonal Fitted Stones	X	X		
Square Fitted Stones	X		X	X
Wall Niches	X	X	X	X
Thatched Roofs	X	X	X	X

Although all four sites are *elite* sites, each in its turn follows a hierarchy in terms of construction and prestige. Regarded as the site with the finest Inca masonry and the greatest quality of stone, Cuzco is set at the apex of the hierarchy of construction and for good reason since it was the center of the Inca cosmos. It would appear to the observer that as one moves farther away from the capital and center of the Inca cosmos (Cuzco) the less luxurious would be the architecture. Although these outlying buildings and construction sites remain impressive, overall they do not prove to be as important or prestigious as those structures that are actually in or near Cuzco.

Regarding general architectural characteristics, there are multiple features that are ubiquitous throughout Inca architecture. Buildings of all sizes and functions share specific attributes within their design. For example, all the sites that I have researched have protrusions or knobs jetting out on a number of the stones used in important structures. These protrusions are located at the lower ends of the stones and were used in handling, lifting, and placement.

Another unique though characteristic feature of Inca architectural style is niches in the walls. Always trapezoidal in shape, these niches can vary widely in size. Although the function of these niches is not fully known, they appear to have been a type of mantel for statues or some form of storage area; perhaps they served only as decoration.

A second type of wall niche is that found within Inca doorways and windows. Usually trapezoidal in form, all Inca buildings had these features. Some of the more prestigious buildings, however, had double or triple-jamb doorways and/or windows, which apparently served the sole purpose of ornamentation and decoration. Even so, the window niches were usually systematic in their distribution within a building and would sometimes line up perfectly with other niched windows in neighboring buildings, allowing for one to see straight through these series of niches to the farthest or ending wall, such as can be seen at the Coricancha at Cuzco and at houses at Machu Picchu.

Another interesting aspect of Inca architecture is what is called battered walls. This is a feature that refers to the fact that Inca buildings were designed to lean inward. It is thought that this strategy of construction allowed for stronger support in holding up the thatched roofs.

As mentioned briefly earlier, all of the sites in my research also incorporate the construction of terraces. Terracing is one of the major manifestations of not only the Inca, but other Andean civilizations as well, their presence being a key to survival in such a mountainous environment. It could be argued in fact that without terraces, hill societies would have experienced extreme difficulty in the farming and growing of crops, in the use of irrigating water, and in living comfortably for that matter. Terracing among important sites and buildings also shows the symbolic significance of expressing power (i.e., the terraces of Pumatallis at Ollantaytambo).

CONCLUDING COMMENT ON FORM AND FUNCTION

In considering the research question of whether "the function of a building has any direct relation to the form," it is imperative to keep in mind that if one switches the question around to "does form follow function?" the answer is not always yes. However, after conducting my research, I have gained the impression that *function* does often play a role in the final *form* of a building. That is, even if one understands the function of a structure first, before emerging himself in the structure's form, he will eventually come to see that certain buildings *do* display aspects of form (an intrinsic quality) that point directly to their functional (or instrumental) qualities.

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